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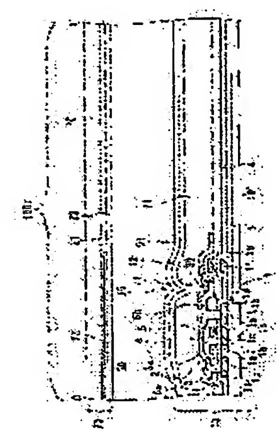
(54) ELECTRO-OPTICAL SUBSTRATE, ELECTRO-OPTICAL DEVICE, METHOD FOR MANUFACTURING THE SAME, AND ELECTRONIC APPARATUS

(57)Abstract:

PROBLEM TO BE SOLVED: To provide an electro-optical device capable of realizing stable characteristics of a semiconductor element and providing a fine display characteristic.

SOLUTION: The electro-optical device is constituted of holding an electro-optical substance between a pair of substrates 10, 20, and provided with a semiconductor element 30 having a semiconductor layer 1 on the substrate 10 and a pixel electrode 91 connected to the semiconductor element 30. A silicon nitride layer 5 formed on the upper layer of the semiconductor layer 1 has at least an aperture at a position which is superposed to a formation area of the pixel electrode 91 on the surface of the substrate.



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CLAIMS

[Claim(s)]
[Claim 1]
It is the electro-optics substrate which comes to have the semiconductor device which has a semi-conductor layer on a base material,
A silicon nitride layer is formed in the upper layer of said semi-conductor layer,
Said silicon nitride layer is an electro-optics substrate characterized by coming to have opening in a flat surface at least.
[Claim 2]
It is the electro-optics substrate which comes to have the pixel electrode connected with the semiconductor device which has a semi-conductor layer on a base material, and this semiconductor device,
A silicon nitride layer is formed in the upper layer of said semi-conductor layer,
Said silicon nitride layer is an electro-optics substrate characterized by coming at least to have opening in the location superimposed to the formation field of said pixel electrode in a flat surface.
[Claim 3]
The electro-optics substrate according to claim 1 or 2 characterized by to form opening of said silicon nitride layer in the location superimposed on the opening field slack transparency viewing area of said reflective film while the reflective film which has opening in a flat surface is formed on said base material, and this opening is made into a transparency viewing area and applied to the display of the transflective reflective mold which made the formation field of the reflective film the reflective viewing area.
[Claim 4]
It is the electro-optic device which comes to pinch electrooptic material between the substrates of a pair,
It has the silicon nitride layer formed on said substrate at the semiconductor device which has a semi-conductor layer, and the upper layer of said semi-conductor layer,
Said silicon nitride layer is an electro-optic device characterized by coming to have opening in said substrate side at least.
[Claim 5]
It is the electro-optic device which comes to pinch electrooptic material between the substrates of a pair,
It has the pixel electrode connected with the semiconductor device which has a semi-conductor layer on said substrate, and this semiconductor device,
A silicon nitride layer is formed in the upper layer of said semi-conductor layer,
Said silicon nitride layer is an electro-optic device characterized by coming at least to have opening in the location superimposed to the formation field of said pixel electrode in said substrate side.
[Claim 6]
Said opening is an electro-optic device according to claim 4 or 5 characterized by superimposing and being formed in the viewing area and flat-surface target of the electro-optic device concerned.
[Claim 7]

It is the electro-optic device which comes to pinch electrooptic material and contains a transparency viewing area and a reflective viewing area between the substrates of a pair,
It has the silicon nitride layer formed on said substrate at the semiconductor device which has a semi-conductor layer, and the upper layer of said semi-conductor layer,
Said silicon nitride layer is an electro-optic device characterized by coming to have opening at least and forming this opening in said substrate side at said transparency viewing area.
[Claim 8]
It is the electro-optic device which comes to pinch electrooptic material and contains a transparency viewing area and a reflective viewing area between the substrates of a pair,
It has the pixel electrode connected with the semiconductor device which has a semi-conductor layer on said substrate, and this semiconductor device,
A silicon nitride layer is formed in the upper layer of said semi-conductor layer,
Said silicon nitride layer is an electro-optic device characterized by coming at least to have opening in the location superimposed on the formation field of said pixel electrode, and forming this opening in said substrate side at said transparency viewing area.
[Claim 9]
The electro-optic device according to claim 7 or 8 characterized by forming the concavo-convex resin layer for forming a concave convex in this reflective film under the reflective film, superimposing on the formation field of this concavo-convex resin layer superficially, and forming said silicon nitride layer in it while the reflective film is formed in said reflective viewing area.
[Claim 10]
It is the manufacture approach of the electro-optic device which comes to pinch electrooptic material and contains a transparency viewing area and a reflective viewing area between the substrates of a pair,
The process which forms the semiconductor device which has a semi-conductor layer on said substrate,
The process which forms a silicon nitride layer in the upper layer of said semi-conductor layer,
The process which forms the resin layer for forming a concave convex in the upper layer of said silicon nitride layer in a reflective viewing area,
The process which carries out patterning of said resin layer and said silicon nitride layer to the flat-surface configuration of the same pattern at the same process,
****** — the manufacture approach of the electro-optic device characterized by things.
[Claim 11]
Electronic equipment characterized by equipping claim 4 thru/or any 1 term of 9 with the electro-optic device of a publication.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]
This invention relates to the manufacture approach of an electro-optics substrate, an electro-optic device, and an electro-optic device, and electronic equipment.
[0002]
[Description of the Prior Art]
Since the pixel of a large number arranged in the shape of a matrix is driven for every pixel as electro-optic devices, such as liquid crystal equipment and electroluminescence (EL) equipment, the display of the active-matrix mold which prepared the thin film transistor (TFT) which is thin film semiconductor equipment in each pixel is known. In the display of this configuration, while insulating a pixel electrode and TFT with an interlayer insulation film, the driving signal from TFT has flowed in the pixel electrode through the contact hole.
[0003]
Moreover, the technique which forms a silicon nitride layer in the upper layer of this semi-conductor layer of TFT is indicated by the patent reference 1 as a purpose which prevents oxidation by covering permeation of moisture to the semi-conductor layer of TFT for the purpose of the hydrogen supply to the semi-conductor layer of TFT or.
[0004]
[Patent reference 1]
JP,9-138426,A
[0005]
[Problem(s) to be Solved by the Invention]
Such a silicon nitride layer has **** which causes the fall of a display property by there being a problem of coloring, for example, forming in a viewing area. In the electro-optic device which has a semiconductor device, this invention carries out the purpose of offering the electro-optics substrate which can offer a good display property, and an electro-optic device while realizing the stable drive of a semiconductor device. Moreover, this invention sets such an electro-optic device as the purpose which offers suitably the manufacture approach of the electro-optic device which can be offered. Furthermore, this invention aims at offering electronic equipment equipped with such an electro-optic device.
[0006]
[Means for Solving the Problem]
In order to attain the above-mentioned purpose, the electro-optics substrate of this invention is an electro-optics substrate which comes to have the semiconductor device which has a semi-conductor layer on a base material, and a silicon nitride layer is formed in the upper layer of said semi-conductor layer, and it is characterized by said silicon nitride layer coming to have opening in a flat surface at least.
[0007]
According to such an electro-optics substrate, since the silicon nitride layer was formed in the upper layer of a semi-conductor layer, it can prevent thru/or control that the component leading to oxidation, such as water and oxygen, infiltrates into this semi-conductor layer, and prevention thru/or control of the property fall of a semiconductor device is attained in it. Moreover, also when a silicon nitride layer is written as the configuration which comes to have opening in a field at least and the electro-optics substrate concerned is applied to an electro-optic device, it becomes possible to avoid the problem to which a display property falls to the field for presenting a display with this opening by coloring based on a silicon nitride layer by carrying out alignment.
[0008]
Moreover, in order to attain the above-mentioned purpose, it is the electro-optics substrate which comes to have the pixel electrode connected with the semiconductor device to which the electro-optics substrate of this invention has a semi-conductor layer on a base material, and this semiconductor

device, and a silicon-nitride layer is formed in the upper layer of said semi-conductor layer, and it is characterized by said silicon-nitride layer coming at least to have opening in the location superimposed to the formation field of said pixel electrode in a flat surface.

[0009]

According to such an electro-optics substrate, since the silicon nitride layer was formed in the upper layer of a semi-conductor layer, it can prevent thru/or control that the component leading to oxidation, such as water and oxygen, infiltrates into this semi-conductor layer, and prevention thru/or control of the property fall of a semiconductor device is attained in it. Moreover, also when it writes as the configuration which comes at least to have opening in the location which superimposes a silicon nitride layer to the formation field of a pixel electrode in a field and the electro-optics substrate concerned is applied to an electro-optic device, it becomes possible to avoid the problem to which a display property falls to the field (pixel viewing area) for presenting a display with this opening by coloring based on a silicon nitride layer by carrying out alignment. In addition, in the electro-optics substrate of this invention, it is desirable to form in the location which can apply to the display of the transflective reflective mold which made this opening the transparency viewing area and made the formation field of the reflective film the reflective viewing area by forming the reflective film which has opening on said base material, and superimposes opening of said silicon nitride layer on the opening field slack transparency viewing area of said reflective film in this case.

[0010]

Next, in order to attain the above-mentioned purpose, it is characterized by the electro-optic device of this invention being an electro-optic device which comes to pinch electrooptic material between the substrates of a pair, and having the semiconductor device which has a semi-conductor layer on said substrate, and the silicon nitride layer formed at the upper layer of said semi-conductor layer, and said silicon nitride layer coming to have opening in said substrate side at least.

[0011]

According to such an electro-optic device, since the silicon nitride layer was formed in the upper layer of a semi-conductor layer, it can prevent thru/or control that the component leading to oxidation, such as water and oxygen, infiltrates into this semi-conductor layer, and prevention thru/or control of the property fall of a semiconductor device is attained in it. Moreover, a silicon nitride layer is written as the configuration which comes to have opening in a substrate side at least, and it becomes possible to avoid the problem to which a display property falls to the field for presenting a display with this opening by coloring based on a silicon nitride layer by carrying out alignment.

[0012]

In order to attain the above-mentioned purpose, moreover, the electro-optic device of this invention The semiconductor device which is the electro-optic device which comes to pinch electrooptic material between the substrates of a pair, and has a semi-conductor layer on said substrate, It has the pixel electrode connected with this semiconductor device, a silicon nitride layer is formed in the upper layer of said semi-conductor layer, and said silicon nitride layer is characterized by coming at least to have opening in the location superimposed to the formation field of said pixel electrode in said substrate side.

[0013]

According to such an electro-optics substrate, since the silicon nitride layer was formed in the upper layer of a semi-conductor layer, it can prevent thru/or control that the component leading to oxidation, such as water and oxygen, infiltrates into this semi-conductor layer, and prevention thru/or control of the property fall of a semiconductor device is attained in it. Moreover, it writes as the configuration which comes at least to have opening in the location which superimposes a silicon nitride layer to the formation field of a pixel electrode in a substrate side, and it becomes possible to avoid the problem to which a display property falls to the field (pixel viewing area) for presenting a display with this opening by coloring based on a silicon nitride layer by carrying out alignment.

[0014]

Said opening can be superimposed and formed in the viewing area and flat-surface target of the electro-optic device concerned in the electro-optic device of this invention. In this case, coloring based on the silicon nitride layer in a viewing area comes to be avoided much more effectively, and becomes possible [offering the electro-optic device which has a good display property].
[0015]
In order to attain the above-mentioned purpose, moreover, the electro-optic device of this invention The semiconductor device which is the electro-optic device which comes to pinch electrooptic material and contains a transparency viewing area and a reflective viewing area between the substrates of a pair, and has a semi-conductor layer on said substrate, It has the silicon nitride layer formed in the upper layer of said semi-conductor layer, and said silicon nitride layer is characterized by coming to have opening at least and forming this opening in said substrate side, at said transparency viewing area.
[0016]
According to such an electro-optic device, since the silicon nitride layer was formed in the upper layer of a semi-conductor layer, it can prevent thru/or control that the component leading to oxidation, such as water and oxygen, infiltrates into this semi-conductor layer, and prevention thru/or control of the property fall of a semiconductor device is attained in it. Moreover, since the silicon nitride layer was considered as the configuration which comes to have opening in a substrate side at least and this opening was formed in the transparency viewing area, it becomes possible to avoid the problem to which the display property of a transparency display falls by coloring based on a silicon nitride layer. In addition, when a reflective metal membrane is formed in a reflective viewing area, it is forming this reflective metal membrane in an upper layer side rather than a silicon nitride layer, and while being able to discover the antioxidizing function of a semi-conductor layer certainly, the light with which a reflective display is presented becomes possible [avoiding the problem of coloring based on the silicon nitride layer in a reflective viewing area] in order not to pass a silicon nitride layer.
[0017]
In order to attain the above-mentioned purpose, moreover, the electro-optic device of this invention The semiconductor device which is the electro-optic device which comes to pinch electrooptic material and contains a transparency viewing area and a reflective viewing area between the substrates of a pair, and has a semi-conductor layer on said substrate, It has the pixel electrode connected with this semiconductor device, and a silicon nitride layer is formed in the upper layer of said semi-conductor layer. Said silicon nitride layer It is characterized by coming at least to have opening in the location superimposed on the formation field of said pixel electrode, and forming this opening in said substrate side, at said transparency viewing area.
[0018]
According to such an electro-optic device, since the silicon nitride layer was formed in the upper layer of a semi-conductor layer, it can prevent thru/or control that the component leading to oxidation, such as water and oxygen, infiltrates into this semi-conductor layer, and prevention thru/or control of the property fall of a semiconductor device is attained in it. Moreover, since it considered as the configuration which comes at least to have opening in the location which superimposes a silicon nitride layer on the formation field of a pixel electrode and this opening was formed in the transparency viewing area, it becomes possible to avoid the problem to which the display property of a transparency display falls by coloring based on a silicon nitride layer. In addition, when a reflective metal membrane is formed in a reflective viewing area, it is forming this reflective metal membrane in an upper layer side rather than a silicon nitride layer, and while being able to discover the antioxidizing function of a semi-conductor layer certainly, the light with which a reflective display is presented becomes possible [avoiding the problem of coloring based on the silicon nitride layer in a reflective viewing area] in order not to pass a silicon nitride layer.
[0019]
In the electro-optic device equipped with the above-mentioned reflective viewing area and the

transparency viewing area, the reflective film is formed in a reflective viewing area, while forming the concavo-convex resin layer for forming a concave convex in this reflective film caudad of the reflective film, it can superimpose on the formation field of this concavo-convex resin layer superficially, and a silicon nitride layer can be formed in it. In this case, a concavo-convex resin layer will be imitated, a concave convex will be formed in the reflective film, and the breadth display property of the angle of visibility in a reflective display improves. Moreover, it writes as the configuration which a concavo-convex resin layer and a silicon nitride layer are superimposed [configuration] superficially, and arranges them, it becomes possible to patternize these irregularity resin layer and a silicon nitride layer according to the same process, and manufacture effectiveness improves. That is, also when forming the resin heights which start a concavo-convex resin layer, for example by the predetermined pattern by the photolithography, it enables it to superimpose a silicon nitride layer on resin heights, and to carry out patterning at the same photolithography process. In addition, as reflective film, for example, the metallic reflection film can be used also in this case, and the thing of this reflective film for which a silicon nitride layer is formed under the concavo-convex resin layer caudad still more preferably is desirable.

[0020]

Next, the manufacture approach of the electro-optic device of this invention comes to pinch electrooptic material between the substrates of a pair. The process which is the manufacture approach of the electro-optic device containing a transparency viewing area and a reflective viewing area, and forms the semiconductor device which has a semi-conductor layer on said substrate, The process which forms a silicon nitride layer in the upper layer of said semi-conductor layer, and the process which forms the resin layer for forming a concave convex in the upper layer of said silicon nitride layer in a reflective viewing area, It is characterized by including the process which carries out patterning of said resin layer and said silicon nitride layer to the flat-surface configuration of the same pattern at the same process.

[0021]

Thus, when the electro-optic device which comes to have a resin layer for forming a concave convex in a reflective viewing area is manufactured including a transparency viewing area and a reflective viewing area, By carrying out patterning to the flat-surface configuration of the same pattern at the same process, a resin layer and a silicon nitride layer For example, it becomes possible to arrange a resin layer and a silicon nitride layer only in a reflective viewing area alternatively, and offer of the electro-optic device which can prevent thru/or control generating of coloring of the display based on a silicon nitride layer in a transparency viewing area is attained. And it writes as what forms a resin layer and a silicon nitride layer in the same process, and manufacture effectiveness will become good.

[0022]

Next, the electronic equipment of this invention is characterized by having the electro-optic device of this invention mentioned above. Thus, in electronic equipment, when an above-mentioned electro-optic device is applied as a display means, it becomes possible to offer the electronic equipment with little coloring which shows a good display.

[0023]

[Embodiment of the Invention]

Hereafter, the gestalt of operation of this invention is explained, referring to a drawing.

(Gestalt of the 1st operation)

First, the 1 operation gestalt is explained with reference to drawing 1 - drawing 5 about the liquid crystal display concerning the electro-optic device of this invention.

The gestalt of this operation gives and explains the example of the transparency mold liquid crystal display of the active matrix which used the TFT (Thin Film Transistor) component as a switching element.

Drawing 1 is the top view which looked at the liquid crystal display of the gestalt of this operation from

the opposite substrate side with each component, and drawing 2 is a sectional view which meets the H-H' line of drawing 1 . Drawing 3 is representative circuit schematics, such as various components in two or more pixels formed in the shape of a matrix in the image display field of an electro-optic device (liquid crystal display), and wiring. In addition, in each drawing used for the following explanation, in order to make each class and each part material into the magnitude of extent which can be recognized on a drawing, the scale is changed for each class or every each part material.
[0024]
In drawing 1 and drawing 2 , in the field which the TFT array substrate 10 and the opposite substrate 20 were stuck by the sealant 52, and was divided by this sealant 52, liquid crystal 50 is enclosed and the liquid crystal display 100 of the gestalt of this operation is held. The circumference abandonment 53 which consists of a protection-from-light nature ingredient is formed in the field inside the formation field of a sealant 52. The data-line drive circuit 201 and the mounting terminal 202 are formed in the field of the outside of a sealant 52 along with one side of the TFT array substrate 10, and the scanning-line drive circuit 204 is formed in it along with two sides which adjoin this one side. Two or more wiring 205 for connecting between the scanning-line drive circuits 204 established in the both sides of an image display field is formed in one side in which the TFT array substrate 10 remains. Moreover, in at least one place of the corner section of the opposite substrate 20, the substrates flow material 206 for taking an electric flow between the TFT array substrate 10 and the opposite substrate 20 is arranged.
[0025]
In addition, you may make it connect electrically and mechanically the terminal block formed in the periphery of the TAB (Tape Automated Bonding) substrate with which LSI for a drive was mounted instead of forming the data-line drive circuit 201 and the scanning-line drive circuit 204 on the TFT array substrate 10, and the TFT array substrate 10 through the anisotropy electric conduction film. In addition, in a liquid crystal display 100, although a phase contrast plate, a polarizing plate, etc. are arranged at the predetermined sense according to the exception of modes of operation, such as the class of liquid crystal 50 to be used, i.e., TN (Twisted Nematic) mode, and STN (Super Twisted Nematic) mode, and the normally white mode / normally black mode, illustration is omitted here.
[0026]
Moreover, in constituting a liquid crystal display 100 as an object for color displays, in the opposite substrate 20, it forms the color filter of red (R), green (G), and blue (B) in the field which counters each pixel electrode which the TFT array substrate 10 mentions later with the protective coat.
[0027]
In the image display field of the liquid crystal display 100 which has such structure, as shown in drawing 3 , while two or more pixel 100a is constituted in the shape of a matrix, TFT30 for pixel switching is formed in each of such pixel 100a, and data-line 6a which supplies the pixel signals S1, S2, —, Sn is electrically connected to the source of TFT30. The pixel signals S1, S2, —, Sn written in data-line 6a may be supplied to this order by line sequential, and you may make it supply them for every group to two or more data-line 6a which adjoin each other. Moreover, scanning-line 3a is electrically connected to the gate of TFT30, and it is constituted so that the scan signals G1, G2, —, Gm may be impressed to scanning-line 3a by line sequential in pulse to predetermined timing at this order. It connects with the drain of TFT30 electrically, and the pixel electrode 91 writes the pixel signals S1, S2, —, Sn supplied from data-line 6a in each pixel to predetermined timing, when only a fixed period makes an ON state TFT30 which is a switching element. Thus, fixed period maintenance of the pixel signals S1, S2, —, Sn of the predetermined level written in liquid crystal through the pixel electrode 91 is carried out between the counterelectrodes 21 of the opposite substrate 20 shown in drawing 2 .
[0028]
In addition, in order to prevent the held pixel signals S1, S2, —, Sn leaking, storage capacitance 60 is added to the liquid crystal capacity and juxtaposition which are formed between the pixel electrode 91 and a counterelectrode 21. For example, as for the electrical potential difference of the pixel electrode

91, only time amount also with triple figures longer than the time amount to which the source electrical potential difference was impressed is held with storage capacitance 60. Thereby, it is improved and the maintenance property of a charge can realize the high liquid crystal display 100 of a contrast ratio. In addition, as shown in drawing 3 , when forming as an approach of forming storage capacitance 60 between capacity line 3b which is wiring for forming storage capacitance 60, you may be any in the case of forming between scanning-line 3a of the preceding paragraph.

[0029]

Drawing 4 is the top view showing one pixel 100a of the TFT array substrate used for the gestalt of this operation. Drawing 5 is the sectional view of pixel 100a in the A-A' line of drawing 4 . In drawing 4 , on the TFT array substrate 10 (refer to drawing 2), it connects with TFT30 (refer to drawing 2) for pixel switching electrically, and the pixel electrode 91 which consists of transparence electric conduction film, such as ITO, is formed in the shape of a matrix. Moreover, along the boundary of the field in which the pixel electrode 91 was formed in every direction, data-line 6a, scanning-line 3a, and capacity line 3b are formed, and TFT30 is connected to data-line 6a and scanning-line 3a.

[0030]

That is, data-line 6a is electrically connected to high concentration source field 1a of TFT30 through a contact hole 8, and the pixel electrode 91 is electrically connected to 1d of high concentration drain fields of TFT30 through a contact hole 15 and drain electrode 6b. Moreover, scanning-line 3a is prolonged so that field 1a' for channel formation of TFT30 may be countered. In addition, storage capacitance 60 (are recording capacitative element) uses as a bottom electrode what electric-conduction-ized 1f of installation parts of the semi-conductor film 1 for forming TFT30 for pixel switching, and has structure to which scanning-line 3a and capacity line 3b of this layer lapped with 1f of bottom [this] electrodes as an upper electrode.

[0031]

A-A shown in drawing 4 as shown in drawing 5 -- the substrate protective coat 11 which thickness becomes from the silicon oxide (insulator layer) which is 100nm - 500nm is formed in the front face of 'the glass substrate 10 for TFT array substrates with a cross section transparent as a base of the TFT array substrate 10 when a line cuts', and the semi-conductor film 1 of the shape of an island whose thickness is 30nm - 100nm is formed in the front face of this substrate protective coat 11. The gate dielectric film 2 with which thickness consists of silicon oxide which is about 50-150nm is formed in the front face of the semi-conductor film 1, and scanning-line 3a whose thickness is 100nm - 800nm is formed in the front face of this gate dielectric film 2 as a gate electrode.

[0032]

The field which counters through gate dielectric film 2 among the semi-conductor film 1 to scanning-line 3a is field 1a' for channel formation. To this field 1a' for channel formation, a source field equipped with low concentration field 1b and high concentration source field 1a is formed, a drain field equipped with low concentration field 1b and 1d of high concentration drain fields is formed in the other side, and high concentration field 1c belonging to neither of the fields, the source nor a drain, is formed in one side in that middle.

[0033]

The 1st interlayer insulation film 4 with which thickness consists of silicon oxide which is 300nm - 800nm, and the 2nd interlayer insulation film (silicon nitride layer) 5 with which thickness consists of a silicon nitride which is 100nm - 800nm are formed in the front-face side of TFT30 for pixel switching. This 2nd interlayer insulation film 5 is functioning as film (surface protective coat) which prevents thru/or controls permeation of the component of TFT30 which becomes oxidation factors, such as water and oxygen, especially to the semi-conductor layer 1. Moreover, data-line 6a whose thickness is 100nm - 800nm is formed in the front face of the 1st interlayer insulation film 4, and this data-line 6a is electrically connected to high concentration source field 1a through the contact hole 8 formed in the 1st interlayer insulation film 4. Furthermore, the 3rd interlayer insulation film 71 which consists this 2nd

interlayer insulation film 5 and the 1st interlayer insulation film 4 of silicon oxide in a wrap mode is formed in the upper layer of the 2nd interlayer insulation film 5.

[0034]

And the pixel electrode 91 which consists of transparence electric conduction film, such as ITO, is formed in the upper layer of the 3rd interlayer insulation film 71. And the transparency display is enabled by making the pixel electrode 91 concerned penetrate the light from the back light which is not illustrated. Moreover, the orientation film 12 which consists of polyimide film is formed in the front-face side of the pixel electrode 91, and rubbing processing is performed to the front-face side of this orientation film 12.

[0035]

In addition, although TFT30 has LDD structure (Lightly Doped Drain structure) as mentioned above preferably, it may have the offset structure which does not drive impurity ion into the field equivalent to low concentration field 1b. Moreover, TFT30 may be TFT of the self aryne mold which drove in impurity ion by high concentration by having used the gate electrode (a part of scanning-line 3a) as the mask, and formed the high-concentration source and a high-concentration drain field in self align.

[0036]

Moreover, although considered as the dual gate (double-gate) structure which has arranged the gate electrode (scanning-line 3a) of TFT30 between [two] source-drain fields with the gestalt of this operation, you may be the single gate structure arranged one piece, and may be the structure more than the triple gate which has arranged three or more gate electrodes among these. When two or more gate electrodes have been arranged, to each gate electrode, the same signal is made to be impressed. Thus, if TFT30 is constituted above the dual gate (double-gate) or the triple gate, the leakage current in the joint of a channel and a source-drain field can be prevented, and the current at the time of OFF can be reduced. If at least one of these gate electrodes is made into LDD structure or offset structure, the OFF state current can be reduced further and the stable switching element can be obtained.

[0037]

On the other hand, in the opposite substrate 20, it is on glass substrate 20' by the side of an opposite substrate, and the light-shielding film 23 called a black matrix or a black stripe is formed in the border area of the pixel electrode 91 on the TFT array substrate 10 in every direction, and the field which counters, and the counterelectrode 21 which consists of ITO film is formed in it at the upper layer side. Moreover, the orientation film 22 which consists of polyimide film is formed in the upper layer side of a counterelectrode 21. And liquid crystal 50 is enclosed between the TFT array substrate 10 and the opposite substrate 20.

[0038]

In the liquid crystal display 100 of this operation gestalt, the configuration which pinched liquid crystal (electrooptic material) with the TFT array substrate (electro-optics substrate) which comes to have TFT30 which has the semi-conductor layer 1, and the pixel electrode 91 on glass substrate 10', and the opposite substrate 20 is made. Here, prevention thru/or control of the component leading to [, such as water and oxygen,] oxidation infiltrating into this semi-conductor layer 1 by forming the 2nd interlayer insulation film (silicon nitride layer) 5 in the upper layer of the semi-conductor layer 1 were enabled, and it made it possible to contribute to maintenance of the good switching characteristic of TFT30.

[0039]

Moreover, as shown in drawing 5 , it presupposed that the 2nd interlayer insulation film 5 is alternatively formed in the formation field of TFT30, and it considered as the configuration which comes to have opening (the 2nd interlayer insulation film agenesis field) in the location superimposed on the formation field of the pixel electrode 91 at least. That is, it made it possible to avoid the problem which coloring generates on the occasion of a display based on the silicon nitride layer which is the constituent of the 2nd interlayer insulation film 5, having written as the configuration which does not form the 2nd interlayer insulation film 5 in the viewing area of the liquid crystal display 100 concerned alternatively,

and maintaining the good property of TFT30.

[0040]

(Gestalt of the 2nd operation)

Next, the 2nd operation gestalt is explained with reference to drawing 6 and drawing 7 about the liquid crystal display concerning the electro-optic device of this invention.

The gestalt of this operation gives and explains the example of the transflective reflective mold liquid crystal display of an active matrix with which the pixel electrode on a component substrate was equipped with the reflective viewing area and the transparency viewing area. In addition, the same sign is given to the thing of the same component as the liquid crystal display of the 1st operation gestalt, and explanation is omitted.

[0041]

Drawing 6 is the top view showing one pixel of the TFT array substrate used for the gestalt of this operation. Drawing 7 is the sectional view of the pixel in the A-A' line of drawing 6 . In addition, the top view which looked at the liquid crystal display from the opposite substrate side with each component, its sectional view, and the representative circuit schematic in the image display field of a liquid crystal display are the same as the configuration of drawing 1 - drawing 3 shown with the 1st operation gestalt, respectively.

[0042]

In drawing 6 and drawing 7 , on the TFT array substrate 10, the pixel electrode 91 which consists of reflective film 9 which consists of cascade screens of aluminum, silver, these alloys or the above-mentioned metal membrane, and metal membranes, such as titanium, titanium nitride, molybdenum, and a tantalum, and transparence electric conduction film, such as ITO formed on this reflective film 9, is formed, and TFT30 for pixel switching is electrically connected to the pixel electrode 91. Moreover, along the boundary of the field in which the pixel electrode 91 was formed in every direction, data-line 6a, scanning-line 3a, and capacity line 3b are formed, and TFT30 is connected to data-line 6a and scanning-line 3a.

[0043]

That is, data-line 6a is electrically connected to high concentration source field 1a of TFT30 through a contact hole 8, and the pixel electrode 91 is electrically connected to 1d of high concentration drain fields of TFT30 through a contact hole 15 and drain electrode 6b. Moreover, scanning-line 3a is prolonged so that field 1a' for channel formation of TFT30 may be countered. In addition, storage capacitance 60 (are recording capacitative element) uses as a bottom electrode what electric-conduction-ized 1f of installation parts of the semi-conductor film 1 for forming TFT30 for pixel switching, and has structure to which scanning-line 3a and capacity line 3b of this layer lapped with 1f of bottom [this] electrodes as an upper electrode.

[0044]

In addition, in the case of this operation gestalt, the pixel electrode 91 will be formed in 9d of openings formed in the reflective film 9, a picture signal will be supplied to liquid crystal from the pixel electrode 91 in 9d field of openings in a transparency display mode, and a display will be presented when the light from a back light (illustration abbreviation) penetrates a liquid crystal layer through 9d of this opening. Moreover, in a reflective display mode, after the natural light which carried out incidence from the opposite substrate 20 side penetrates the liquid crystal 50 driven with the pixel electrode 91 and penetrates this pixel electrode 91 further, it reflects by the reflective film 9, and a display will be presented, after penetrating liquid crystal 50 again. Furthermore, although considered as the configuration which connects electrically the pixel electrode 91 and drain electrode 6b with this operation gestalt, it is good also as what connects the reflective film 9 with drain electrode 6b, performs electrical installation of this reflective film 9 and the pixel electrode 91, and performs each display in a reflective viewing area and a transparency viewing area.

[0045]

drawing 7 — being shown — as — this — reflection — a field — A-A — ' — a line — having cut — the time — a cross section — TFT — an array — a substrate — ten — a base — ****** — being transparent — TFT — an array — a substrate — ** — a glass substrate — ten — ' — a front face — thickness — 100 — nm - 500 — nm — it is — silicon oxide (insulator layer) — from — becoming — a substrate — a protective coat — 11 — forming — having — this — a substrate — a protective coat -- 11 — a front face — **** — thickness — 30 — nm - — 100 — nm — it is — an island — ** — a semi-conductor — the film — one — forming — having — **** — . The gate dielectric film 2 with which thickness consists of silicon oxide which is about 50-150nm is formed in the front face of the semi-conductor film 1, and scanning-line 3a whose thickness is 100nm - 800nm is formed in the front face of this gate dielectric film 2 as a gate electrode.

[0046]

The 1st interlayer insulation film 4 with which thickness consists of silicon oxide which is 300nm - 800nm, and the 2nd interlayer insulation film (silicon nitride layer) 5 with which thickness consists of a silicon nitride which is 100nm - 800nm are formed in the front-face side of TFT30 for pixel switching. Moreover, it is formed in the upper layer of the 1st interlayer insulation film 4 in the form where the heights formation section slack resin heights (concavo-convex resin layer) 72 constituted considering acrylic resin as a subject were scattered, and the 3rd interlayer insulation film 71 which consists of silicon oxide is formed in the upper layer of this resin heights 72 and 2nd interlayer insulation film 5. In addition, corresponding to the formation location of the resin heights 72, heights pattern 9g which has a gently-sloping curve side is formed in the front face of the 3rd interlayer insulation film 71. The resin heights 72 consist of resin with high transparency, and the permeability of light with a wavelength of 400nm specifically consists of 95% or more of resin. That is, it has the composition of having avoided coloring of yellow seen by acrylic resin by the predetermined approach.

[0047]

And the reflective film 9 which consists of a cascade screen of aluminum, silver, these alloys or these metal membranes, and metal membranes, such as titanium, titanium nitride, molybdenum, and a tantalum, is formed in the upper layer of the 3rd interlayer insulation film 71. 9d of openings is formed in the reflective film 9 for every pixel, and the pixel electrode 91 which consists of transparence electric conduction film, such as ITO, is formed at it on this reflective film 9 and 9d of these openings. And the transparency display is enabled by making the light from the back light which is not illustrated penetrate from 9d of openings. Moreover, the orientation film 12 which consists of polyimide film is formed in the front-face side of the pixel electrode 91, and rubbing processing is performed to the front-face side of this orientation film 12.

[0048]

In the liquid crystal display of such a configuration, the resin heights 72 will be imitated, a concave convex will be formed in the reflective film 9, and the breadth display property of the angle of visibility in a reflective display improves. Moreover, since the 2nd interlayer insulation film (silicon nitride layer) 5 was formed in the upper layer of the semi-conductor layer 1, prevention thru/or control of the component leading to [, such as water and oxygen,] oxidation infiltrating into this semi-conductor layer 1 were enabled, and it made it possible to contribute to maintenance of the good switching characteristic of TFT30. And as shown in drawing 7 , it presupposed that the 2nd interlayer insulation film 5 is alternatively formed in the formation field of TFT30, and it considered as the configuration which does not form the 2nd interlayer insulation film 5 in the formation location of 9d of openings of the reflective film 9, i.e., the location superimposed on a transparency viewing area, at least. Therefore, it made it possible to avoid the problem which coloring generates on the occasion of a transparency display based on the silicon nitride layer which is the constituent of the 2nd interlayer insulation film 5, maintaining the good property of TFT30.

[0049]

In addition, as shown in drawing 8 , it is good also as what forms the interlayer insulation film 48 which

consists the 2nd interlayer insulation film 5 and the 1st interlayer insulation film 4 of silicon oxide in a wrap mode, and forms the above-mentioned resin heights 72 and the 3rd above-mentioned interlayer insulation film 71 on this interlayer insulation film 48. Moreover, as shown in drawing 9 , in order to form heights pattern 9g in the reflective film 9, the concavo-convex resin layer 73 with a concavo-convex front face can also be formed. Generating of display faults, such as coloring based on the concavo-convex resin layer 73 concerned, can be prevented by forming 73d of openings in the concavo-convex resin layer 73 in the form superimposed on the formation field of 9d of openings of the reflective film 9 in this case.

[0050]

Furthermore, as shown in drawing 10 , the 2nd interlayer insulation film 5 and the resin layer 72 for forming heights pattern 9g of the reflective film 9 can be superimposed superficially, and can also be arranged. In this case, it writes as the configuration in which superimpose superficially the resin layer 72 and the 2nd interlayer insulation film 5, and they are made to arrange, it becomes possible to carry out pattern formation of these resin layer 72 and the 2nd interlayer insulation film 5 according to the same process, and manufacture effectiveness improves. That is, when forming the resin layer 72 by the predetermined pattern (a random pattern is included) by the photolithography, for example, it becomes possible to imitate and carry out patterning of the 2nd interlayer insulation film 5 to the resin layer 72 at the same photolithography process. In addition, it is possible to acquire the antioxidizing effectiveness of the semi-conductor layer 1 by the 2nd interlayer insulation film 5 and the prevention effectiveness of coloring in a transparency display also in this case.

[0051]

(The manufacture approach of a liquid crystal display)

Next, the manufacture approach of the liquid crystal display shown in drawing 10 is concretely explained as an example of the manufacture approach of the electro-optic device of this invention, referring to a drawing. Drawing 11 - drawing 14 are the sectional views showing the manufacture approach of the TFT array substrate 10 of the gestalt this operation in order of a process.

[0052]

first — drawing 11 — (— A —) — being shown — as — ultrasonic cleaning — etc. — having defecated — TFT — an array — a substrate — ** — a glass substrate — ten — ' — having prepared — after — a substrate — temperature — 150 — degree C - 450 — degree C — it is — temperature — conditions — the bottom — TFT — an array — a substrate — ** — a glass substrate — ten — ' — the whole surface — silicon oxide — from — becoming — a substrate — a protective coat — 11 — a plasma-CVD method — the thickness of 100nm - 500nm — forming . As material gas at this time, the mixed gas of a mono silane and laughter gas (dinitrogen oxide), TEOS (tetra-ethoxy silane: Si4 (OC2H5)) and oxygen or a disilane, and ammonia can be used, for example.

[0053]

Next, substrate temperature forms in the thickness of 30nm - 100nm the semi-conductor film 1 which consists of amorphous silicon film by the plasma-CVD method all over glass substrate 10' for TFT array substrates under the temperature conditions which are 150 degrees C - 450 degrees C. As material gas at this time, a disilane and a mono silane can be used, for example. Next, a laser beam is irradiated to the semi-conductor film 1, and laser annealing is given. Consequently, the amorphous semi-conductor film 1 is fused once, and is crystallized through a cooling solidification process.

[0054]

Next, by using a photolithography technique for the front face of the semi-conductor film 1, and etching the semi-conductor film 1 through the resist mask 551, as shown in drawing 11 (B), the semi-conductor film for forming the island-like semi-conductor film 1 (active layer) is formed in the condition of having dissociated respectively.

[0055]

Next, the gate dielectric film 2 which consists of silicon oxide etc. with a CVD method etc. is formed in

the thickness of 50nm – 150nm under temperature conditions 350 degrees C or less all over glass substrate 10' including the front face of the semi-conductor film 1 for TFT array substrates. The mixed gas of TEOS and oxygen gas can be used for the material gas at this time. Next, although illustration is omitted, impurity ion is driven into 1f of installation parts of the semi-conductor film 1 through a predetermined resist mask, and the bottom electrode for constituting storage capacitance 60 between capacity line 3b is formed.
[0056]
Next, by a spatter etc., as shown in drawing 11 (C), after forming in the thickness of 100nm – 800nm the electric conduction film 3 which consists of a metal membrane which consists of the aluminum for forming scanning-line 3a etc., a tantalum, molybdenum, etc. all over glass substrate 10' for TFT array substrates, or alloy film which uses either of these metals as a principal component, the resist mask 552 is formed using a photolithography technique. Then, as dry etching of the electric conduction film 3 is carried out and it is shown in drawing 11 (D) through a resist mask, scanning-line 3a (gate electrode), capacity line 3b, etc. are formed.
[0057]
Next, impurity ion (phosphorus ion) low-concentration with the dose of about 0.1x1013-/cm2 – about 10x1013-/cm2 is driven in by using scanning-line 3a and a gate electrode as a mask, and low concentration field 1b is formed in the pixel TFT section and N channel TFT section (not shown) side of a drive circuit in self align to scanning-line 3a. Here, it is located just under scanning-line 3a, and the part into which impurity ion was not introduced becomes field 1a' for channel formation with the semi-conductor film 1.
[0058]
Next, as shown in drawing 12 (A), in the TFT section for pixels, from scanning-line 3a (gate electrode), the resist mask 553 with wide width of face is formed, high-concentration impurity ion (phosphorus ion) is driven in with the dose of about 0.1x1015-/cm2 – about 10x1015-/cm2, and high concentration source field 1a, high concentration field 1c, and 1d of high concentration drain fields are formed.
[0059]
It may replace with these impurity installation processes, the high-concentration impurity (phosphorus ion) in the condition of having formed the resist mask with width of face wider than a gate electrode, without driving in a low-concentration impurity may be driven in, and the source field and drain field of offset structure may be formed. Moreover, scanning-line 3a may be used as a mask, a high-concentration impurity may be driven in, and the source field and drain field of self aryne structure may be formed.
[0060]
Next, as shown in drawing 12 (B), the interlayer insulation film 4 which is from silicon oxide etc. on the front-face side of scanning-line 3a with a CVD method etc. is formed in the thickness of 300nm – 800nm. The mixed gas of TEOS and oxygen gas can be used for the material gas at this time. Next, the resist mask 554 is formed using a photolithography technique. And dry etching of an interlayer insulation film 4 is performed through the resist mask 554, and as shown in drawing 12 (C), in an interlayer insulation film 4, a contact hole is formed in the part corresponding to a source field and a drain field etc., respectively.
[0061]
Next, as shown in drawing 12 (D), after forming in the thickness of 100nm – 800nm the aluminum film for constituting data-line 6a (source electrode) etc., the titanium film, the titanium nitride film, the tantalum film, the molybdenum film, the alloy film that uses either of these metals as a principal component, or the metal membrane 6 which consists of a cascade screen by a spatter etc., the resist mask 555 is formed in the front-face side of an interlayer insulation film 4 using a photolithography technique. Next, dry etching is performed to a metal membrane 6 through the resist mask 555, and as shown in drawing 13 (A), data-line 6a and drain electrode 6b are formed. A metal membrane 6 may be processed by wet

etching.

[0062]

Next, as shown in drawing 13 (B), the 2nd interlayer insulation film 5 which consists of a silicon nitride is formed in the front-face side of data-line 6a and drain electrode 6b with a CVD method etc. at 100nm - 800nm thickness. Furthermore, as shown in drawing 13 (C), after applying with a spin coat method, the photo mask 556 of a predetermined pattern is formed for the resin layer 72 of the translucency of organic systems, such as acrylic resin, at the thickness of 1.0-micrometer or more extent, and patterning of the resin layer 72 and the 2nd interlayer insulation film 5 is carried out using a photolithography technique. As shown in drawing 13 (D), of such a processing process, the resin layer 72 which has two or more heights will be formed in a front face, and the 2nd interlayer insulation film 5 will be formed in the lower layer of this resin layer 72 of it in the form superimposed on the resin layer 72.

[0063]

Under the present circumstances, what is necessary is just to use the photo mask with which the part of a heights pattern became a protection-from-light pattern, in using the photopolymer of POJITAIPU as a resin layer 72 temporarily although the photo mask which has a pattern corresponding to the heights pattern which should be formed is used. Moreover, what is necessary is just to use the photo mask with which the part of a heights pattern became a light transmission pattern, in using the photopolymer of NEGATAIPU.

[0064]

Next, as shown in drawing 14 (A), the silicon oxide used as the 3rd interlayer insulation film 71 is formed in the upper layer of the 1st interlayer insulation film 4 with which the 2nd interlayer insulation film 5 and the resin layer 72 were formed using a CVD method etc., and the reflective film 9 which consists of aluminum etc. further is formed for example, by the sputtering method etc. In addition, after membrane formation of the reflective film 9 (for example, a photolithography technique), and using an etching technique, patterning of the reflective film 9 is carried out, and 9d of openings is formed.

[0065]

And as shown in drawing 14 (B), the pixel electrode 91 and the orientation film 12 which carried out rubbing processing which is made to carry out opening of the contact hole 15 in the form which penetrates the 3rd interlayer insulation film 71 and the resin layer 72, and the 2nd interlayer insulation film 72 until it arrives at the front face of drain electrode 6b, and consists of ITO further are formed with a photolithography technique, and the TFT array substrate 10 is manufactured.

[0066]

substrate body 20' which consists of glass etc. about the opposite substrate 20 on the other hand — preparing — substrate body 20' — depositing transparent conductive ingredients, such as ITO, by the sputtering method etc., and carrying out patterning using the photolithography method, after forming a light-shielding film 23 in the field corresponding to between surface pixels — substrate body 20' — the common electrode 21 is mostly formed in the whole surface. Furthermore, after applying the coating liquid for orientation film formation all over the common electrode 21, by performing rubbing processing, the orientation film 22 is formed and the opposite substrate 20 is manufactured.

[0067]

Liquid crystal is poured into the space between both substrates by approaches, such as lamination and the vacuum pouring-in method, through a sealant so that the orientation film 12 and 22 may counter mutually the TFT array substrate 10 and the opposite substrate 20 which were manufactured as mentioned above, and the liquid crystal layer 50 is formed. Finally a phase contrast plate, a polarizing plate, etc. are stuck on the outside of the liquid crystal cell made in this way if needed, and the liquid crystal display of this operation gestalt shown in drawing 10 is completed.

[0068]

In the manufacture process of an above-mentioned liquid crystal display, in case the TFT array substrate 10 is manufactured, it is carrying out patterning of the resin layer 72 and the 2nd interlayer

insulation film 5 to the flat-surface configuration of the same pattern at the same process, and it becomes possible to arrange alternatively this resin layer 72 and the 2nd interlayer insulation film 5 only in a reflective viewing area, and manufacture effectiveness will become good as compared with the case where patterning of each class is carried out separately.
[0069]
As mentioned above, what is necessary is to form opening only in the location corresponding to a viewing area by the photolithography method to the 2nd interlayer insulation film 5 about the example of the liquid crystal display shown in drawing 5 , drawing 7 - drawing 9 , etc., although the manufacture approach of the electro-optic device of this invention was explained. While the 2nd interlayer insulation film 5 can be alternatively formed in the upper layer of the semi-conductor layer 1 by this, the 2nd interlayer insulation film 5 shall not be formed in the field which contributes to a display.
[0070]
[Electronic equipment]
The example of electronic equipment equipped with the liquid crystal display of the gestalt of the above-mentioned implementation is explained.
Drawing 15 is the perspective view having shown an example of a cellular phone. In drawing 15 , a sign 1000 shows the body of a cellular phone, and the sign 1001 shows the liquid crystal display section using the above-mentioned liquid crystal display. When the liquid crystal display concerning this invention is used for electronic equipment, such as such a cellular phone, a bright reflective display can be checked by looking with a large angle of visibility, and electronic equipment equipped with the display excellent in the display property without coloring etc. can be realized in a transparency display.
[0071]
In addition, the technical range of this invention can add various modification in the range which is not limited to the gestalt of the above-mentioned implementation and does not deviate from the meaning of this invention. For example, although the gestalt of the above-mentioned implementation showed the example which applied this invention to the liquid crystal display of the active matrix which used TFT as the switching element, it is also possible to apply this invention to the liquid crystal display of the active matrix which used TFD as the switching element.
[Brief Description of the Drawings]
[Drawing 1] The top view which looked at the liquid crystal display of the 1st operation gestalt of this invention from the opposite substrate side with each component.
[Drawing 2] The sectional view which meets the H-H' line of drawing 1 .
[Drawing 3] Representative circuit schematics, such as various components in two or more pixels formed in the shape of a matrix in the image display field of the liquid crystal display of drawing 1 , and wiring.
[Drawing 4] The top view showing one pixel of the TFT array substrate of the liquid crystal display of drawing 1 .
[Drawing 5] The sectional view of the pixel in the A-A' line of drawing 4 .
[Drawing 6] The top view showing one pixel about the liquid crystal display of the 2nd operation gestalt of this invention.
[Drawing 7] The sectional view of the pixel in the A-A' line of drawing 6 .
[Drawing 8] The sectional view showing the modification of the liquid crystal display of the 2nd operation gestalt.
[Drawing 9] The sectional view showing the modification of the liquid crystal display of the 2nd operation gestalt.
[Drawing 10] The sectional view showing the modification of the liquid crystal display of the 2nd operation gestalt.
[Drawing 11] The process sectional view showing the manufacture approach of the liquid crystal display shown in drawing 10 .

[Drawing 12] The process sectional view following drawing 11 .
[Drawing 13] The process sectional view following drawing 12 .
[Drawing 14] The process sectional view following drawing 13 .
[Drawing 15] The perspective view showing an example of the electronic equipment of this invention.
[Description of Notations]
1 [— A TFT array substrate (electro-optics substrate), 30 / — TFT (semiconductor device)] — A semi-conductor layer, 5 — The insulating layer between the 2nd layer (silicon nitride layer), 10' — A glass substrate (base material), 10

[Translation done.]

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1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The top view which looked at the liquid crystal display of the 1st operation gestalt of this invention from the opposite substrate side with each component.
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[Drawing 4] The top view showing one pixel of the TFT array substrate of the liquid crystal display of drawing 1 .
[Drawing 5] The sectional view of the pixel in the A-A' line of drawing 4 .
[Drawing 6] The top view showing one pixel about the liquid crystal display of the 2nd operation gestalt of this invention.
[Drawing 7] The sectional view of the pixel in the A-A' line of drawing 6 .
[Drawing 8] The sectional view showing the modification of the liquid crystal display of the 2nd operation gestalt.
[Drawing 9] The sectional view showing the modification of the liquid crystal display of the 2nd operation gestalt.
[Drawing 10] The sectional view showing the modification of the liquid crystal display of the 2nd operation gestalt.
[Drawing 11] The process sectional view showing the manufacture approach of the liquid crystal display shown in drawing 10 .
[Drawing 12] The process sectional view following drawing 11 .
[Drawing 13] The process sectional view following drawing 12 .
[Drawing 14] The process sectional view following drawing 13 .
[Drawing 15] The perspective view showing an example of the electronic equipment of this invention.
[Description of Notations]

1 [-- A TFT array substrate (electro-optics substrate), 30 / -- TFT (semiconductor device)] -- A semi-conductor layer, 5 -- The insulating layer between the 2nd layer (silicon nitride layer), 10' -- A glass substrate (base material), 10

[Translation done.]